# APPENDIX C.2

# AIR RESOURCES

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# C.2 Air Resources

## C.2.1 INTRODUCTION

The characterization of air resources and assessment of impacts of waste processing and facility disposition alternatives required an extensive program of emissions estimation, air dispersion modeling, and evaluation of results. The complexity and scope of the required analyses were driven by factors such as the large number of projects encompassed by the waste processing and facility disposition alternatives, the large number of specific air pollutants (including various radionuclides, criteria air pollutants and toxic air pollutants) that are potentially associated with these projects, and the many air-quality related criteria against which impacts should be compared. As a result, the methodology and findings described in the main body of the text are primarily of a summary nature. The purpose of this appendix is to provide supporting information and additional detail to support those findings. In particular, this appendix supports the information presented in the air resources sections pertaining to the affected environment (Section 4.7), and environmental consequences of waste processing alternatives (Section 5.2.6) and facility disposition alternatives (Section 5.3.4).

The air resource assessments performed in support of this EIS relied heavily on information contained in numerous technical reports, project-specific data summaries, and other related documents. The following are among the more important of these information sources:

- The SNF & INEL EIS (DOE 1995) was used as a source of information on existing air resource conditions and projected increases in pollutant emissions as a result of future operations not associated with waste processing. In some cases (e.g., emission rates and offsite radiation dose from existing facilities), DOE supplemented this information with more recent data. In other cases, the data or assessment results were modified to reflect current conditions. These changes are described in the sections in which they are reported.

- INEEL radiological National Emission Standards for Hazardous Air Pollutants reports for the calendar years 1995 and 1996 (DOE 1996a, 1997a) were used to establish the existing radiological conditions in terms of airborne radionuclide emissions and highest dose to an offsite receptor.

- INEEL air emissions inventory for the years 1996 and 1997 (DOE 1997b, 1998) were used to update the criteria pollutant emission rates from existing INEEL facilities. These were compared with the emission rates which were used in the SNF & INEL EIS to ensure that the current rates are within the bounds of those used in the SNF & INEL EIS as a basis for characterizing existing conditions through atmospheric dispersion modeling.

- Project data summaries (Appendix C.6) and supporting engineering design files were used as sources of information for emissions-related parameters that pertain to the construction, startup and testing, operation, and decontamination and decommissioning of the proposed projects. These documents, which were prepared specifically for this EIS, provide information such as projected operating schedules, fossil fuel usage, fugitive dust generation, and radiological and non-radiological emission rates.

This appendix attempts to integrate the descriptions of methods, assumptions, results, and other key information from the technical evaluations and summaries cited above into a single source. The remainder of this section is organized as follows:

- Section C.2.2 contains a description of air quality standards and regulations and a discussion of how they apply to sources at INEEL.

- Section C.2.3 provides supporting information on the methods and assumptions used to estimate emissions and assess baseline conditions and impacts of proposed facilities.

- Section C.2.4 provides supplemental detail on radionuclide emission rates from waste processing alternatives, as well as the potential radiation dose consequences of these emissions.

- Section C.2.5 provides supplemental detail on nonradiological pollutant emission rates from waste processing alternatives, as well as the potential environmental consequences of these emissions.

- Section C.2.6 describes radiological emissions and potential dose consequences of facility disposition alternatives.

- Section C.2.7 describes nonradiological emissions from facility disposition alternatives and potential environmental consequences of these emissions.

## C.2.2 AIR QUALITY STANDARDS AND REGULATIONS

Air quality regulations have been established by Federal and State agencies to protect the public from potential harmful effects of air pollution. The Federal Clean Air Act establishes the framework to protect the nation's air resources and public health and welfare. The EPA and the State of Idaho are jointly responsible for establishing and implementing programs that meet the requirements of the Act. These regulations are based on an overall strategy that incorporates the following principal elements:

- Designation of acceptable levels of pollution in ambient air to protect public health and welfare
- Implementation of a permitting program to regulate (control) emissions from stationary (nonvehicular) sources of air pollution
- Issuance of prohibitory rules, such as rules prohibiting open burning.

Facilities planned or currently operating at INEEL are subject to air quality regulations and standards established under the Clean Air Act and by the State Department of Health and Welfare, Division of Environmental Quality, and to internal policies and requirements developed by DOE for the protection of the environment and health. At INEEL, programs have been developed and implemented to ensure compliance with air quality regulations by (a) identifying sources of air pollutants and obtaining necessary State and Federal permits, (b) providing adequate control of emissions of air pollutants, (c) monitoring emissions sources and ambient levels of air pollutants to ensure compliance with air quality standards, (d) operating within permit conditions, and (e) obeying prohibitory rules. Air quality standards and programs applicable to INEEL operations are summarized in Table C.2-1 and are described in further detail below. This section also provides information on project design features to mitigate air quality impacts and operate within the bounds of regulatory requirements.

#### C.2.2.1 Ambient Air Quality Standards

The Federal Clean Air Act establishes National Ambient Air Quality Standards to protect public health and welfare. Primary standards define the ambient concentration of an air pollutant below which no adverse impact to human health is expected. A second category of standards (called secondary standards) has been established to prevent adverse impacts to public welfare, including aesthetics, property, and vegetation. Certain standards apply to long-term (annual average) conditions; others are short-term, applying to conditions that persist for periods ranging from one hour to three months, depending on the toxic properties of the pollutant in question. Ambient standards have been developed for only a few specific contaminants, namely, respirable particulate matter (particles not larger than 10 micrometers in diameter, which tend to remain in the lung when inhaled), sulfur dioxide, nitrogen dioxide, carbon monoxide, lead, and ozone. In addition, the State of Idaho has also established an

**Table C.2-1.** Overview of Federal, state, and DOE programs for air quality management.

| Clean Air Act | | |
|---|---|---|
| Federal Program | State of Idaho Administration Program | DOE Compliance Program |
| **National Ambient Air Quality Standards**<br>• Set limits on ambient air concentrations of sulfur dioxide, nitrogen dioxide, respirable particulate matter, carbon monoxide, lead, and ozone (criteria pollutants).<br>• Primary standards for protection of public health; secondary standards for protection of public welfare.<br>**Prevention of Significant Deterioration**<br>• Limits deterioration of air quality and visibility in areas that are better than the National Ambient Air Quality Standards.<br>• Requires Best Available Control Technology on major sources in attainment areas.<br>**New Source Performance Standards**<br>• Regulate emissions from specific types of industrial facilities (for example, fossil fuel-fired steam generators and incinerators).<br>**National Emission Standards for Hazardous Air Pollutants**<br>• Control airborne emissions of specific substances harmful to human health.<br>• Specific provisions regulate hazardous air pollutants and limit radionuclide dose to a member of the public to 10 millirem per year.<br>• Control emission of hazardous air pollutants from combustion of hazardous waste.<br>**Clean Air Act Amendments of 1990**<br>• Sweeping changes to the Clean Air Act, primarily to address acid rain, nonattainment of National Ambient Air Quality Standards, operating permits, hazardous air pollutants, potential catastrophic releases of acutely hazardous materials, and stratospheric ozone depletion.<br>• Specific rules and policies not yet fully developed and implemented in all areas (for example, hazardous air pollutants). | **Rules for the Control of Air Pollution in Idaho**<br>Current Regulations of the State of Idaho Department of Health and Welfare (IDHW 1997) include:<br>• **Idaho Ambient Air Quality Standards** - Similar to National Ambient Air Quality Standards but also include standards for total fluorides.<br>• **New Source Program** - Permit to Construct is required for essentially any construction or modification of a facility that emits an air pollutant; major facilities require Prevention of Significant Deterioration analysis and Permit to Construct.<br>• **Carcinogenic and Noncarcinogenic Toxic Air Pollutant Increments** - Defines acceptable ambient concentrations for many specific toxic air pollutants associated with sources constructed or modified after May 1, 1994; requires demonstration of preconstruction compliance with toxic air pollutant increments.<br>• **Operating Permits** - Required for nonexempt sources of air pollutants; define operating conditions and emissions limitations, as well as monitoring and reporting requirements.<br>**Rules and Standards for Hazardous Waste**<br>• Includes standards for hazardous waste treatment facilities, including limits on emissions.<br>• Consistent with Federal standards. | Policy to comply with applicable regulations and maintain emissions at levels as low as reasonably achievable.<br>Policy implemented through DOE orders:<br>• DOE (Headquarters) orders apply to all DOE and DOE-contractor operations.<br>• DOE-Idaho Operations Office (DOE-ID) supplemental directives provide direction and guidance specific to the INEEL.<br>The most relevant DOE orders and their DOE-ID supplemental directives are:<br>• DOE Order 5400.1 establishes general environmental protection program requirements and assigns responsibilities for ensuring compliance with applicable laws, regulations, and DOE policy.<br>• DOE Order 5400.5 provides guidelines and requirements for radiation protection of the public.<br>• DOE Order 5480.1B establishes the Environment, Safety, and Health Program for DOE operations (implemented via DOE-ID Supplemental Directive 5480.1).<br>• DOE Order 5480.4 prescribes the application of mandatory Environment, Safety, and Health standards that shall be used by all DOE and DOE-contractor operations (implemented via DOE-ID Supplemental Directive 5480.4).<br>• DOE Order 5480.19 provides guidelines and requirements for plans and procedures in conducting operations at DOE facilities (implemented via DOE-ID Supplemental Directive 5480.19). |

additional State ambient air quality standard for fluorides in vegetation. This standard, however, is less restrictive than more recently promulgated increments for toxic air pollutants. In this EIS, "criteria air pollutant" standards are used in the regulatory compliance evaluations of projected emissions from HLW processing alternatives.

The EPA and State of Idaho have monitored ambient air quality in an attempt to define areas as either attainment (that is, the standards are not exceeded) or nonattainment of the ambient air quality standards, although many areas are unclassified due to a lack of regional monitoring data. The attainment status is specific to each pollutant and averaging time. Designation as either attainment or nonattainment not only indicates the quality of the air resource, but also dictates the elements that must be included in local air quality regulatory control programs. Unclassified areas are generally treated as being in attainment. The elements required in nonattainment areas are more comprehensive (or stricter) than in attainment areas. The region that encompasses the environs of INEEL has been classified as attainment or unclassified for all National Ambient Air Quality Standards, meaning that air pollution levels are considered healthful. The nearest nonattainment area lies some 50 miles south of the INEEL in Power and Bannock Counties, which has been designated as nonattainment for the standards related to respirable particulate matter.

#### C.2.2.2 Prevention of Significant Deterioration

The Clean Air Act contains requirements to prevent the deterioration of air quality in areas designated as attainment of the ambient air quality standards. These requirements are contained in the Prevention of Significant Deterioration amendments and are administered through a program that limits the increase in specific air pollutants above the levels that existed in what has been termed a baseline (or starting) year. The amendments specify maximum allowable ambient pollutant concentration increases, or increments. Increment limits for pollutant level increases are specified for the nation as a whole (designated as Class II areas), and more stringent increment limits (as well as ceilings) are prescribed for designated national resources, such as national forests, parks, and monuments (designated as Class I areas). In Southeastern Idaho, the Craters of the Moon Wilderness Area is the only Class I area. Increment values applicable to the INEEL are presented in Section 4.7 (see Tables 4-12 and 4-13).

The State of Idaho Department of Health and Welfare, Division of Environmental Quality administers the Prevention of Significant Deterioration Program. Proposed new sources of emissions at INEEL and modifications are evaluated to determine the expected level of emissions of all pollutants. The INEEL is considered a major source, since facility-wide emissions of some air contaminants exceed 250 tons per year. As such, a Prevention of Significant Deterioration analysis must be performed whenever any modification would result in a significant net increase of any air pollutant. Levels of significance range from very small quantities (less than one pound) to over 100 tons per year, depending on the toxic nature of the substance. Significance levels specified by the State of Idaho for nonradiological pollutants are presented in Table C.2-2. For radionuclides, significance levels range from any increase in emissions to that which would result in an offsite dose of 0.1 millirem per year or greater, depending on total facility emissions.

**Table C.2-2.** Significance levels specified by the State of Idaho for nonradiological pollutants.[a]

| Pollutant | Significance level (tons per year) | Pollutant | Significance level (tons per year) |
|---|---|---|---|
| Carbon monoxide | 100 | Beryllium | $4.0\times10^{-4}$ |
| Nitrogen oxides | 40 | Mercury | 0.1 |
| Sulfur dioxide | 40 | Vinyl chloride | 1 |
| Particulate matter | | Fluorides | 3 |
| Total particulate matter | 25 | Sulfuric acid mist | 7 |
| Respirable particulates[b] | 15 | Hydrogen sulfide ($H_2S$) | 10 |
| Volatile organic compounds[c] | 40 | Total reduced sulfur (including $H_2S$) | 10 |
| Lead | 0.6 | Reduced sulfur compounds (including $H_2S$) | 10 |
| Asbestos | $7.0\times10^{-3}$ | | |

a. From IDAPA 16.01.01.006 (IDHW 1997).
b. Airborne particulate matter with a particle diameter of 10 micrometers or less.
c. Used as a surrogate for ozone.

If an INEEL facility requires a Prevention of Significant Deterioration permit, it must be demonstrated that the source:

- Will be constructed using best available control technology (a level of control which is technologically feasible and considered cost-effective) to reduce air emissions
- Will operate in compliance with all prohibitory rules
- Will not cause a detriment to ambient air quality at the nearby Craters of the Moon Wilderness Area, a Prevention of Significant Deterioration Class I area
- Will not cause exceedance of Class II increments at locations of ambient air
- Will not adversely affect visibility

The evaluation also includes an assessment of potential growth and associated impacts to air quality-related values—visibility, vegetation, and soils. Generally, all Prevention of Significant Deterioration projects must go through a public comment period with an opportunity for public review. The INEEL has been granted more than 20 Prevention of Significant Deterioration permits by the Division of Environmental Quality.

### C.2.2.3 National Emission Standards for Hazardous Air Pollutants

In addition to ambient air quality standards and Prevention of Significant Deterioration requirements, the Clean Air Act designates requirements for sources that emit substances designated as hazardous air pollutants. These requirements are specified in a program termed National Emission Standards for Hazardous Air Pollutants. This program was substantially amended in 1990 and has yet to be fully implemented. However, one section of the National Emission Standards for Hazardous Air Pollutants program that currently applies to INEEL operations is contained in Title 40 of the Code of Federal Regulations Part 61, Subpart H, *National Emissions Standards for Radionuclides from Department of Energy Facilities*. This regulation establishes a limit to the dose that may be received by a member of the public due to operations at INEEL. The annual dose limit (10 millirem) applies to the maximally-exposed offsite individual and is designed to be protective of human health with an adequate margin of safety. The regulation also establishes requirements for monitoring emissions from facility operations and analysis and reporting of dose.

The INEEL complies with the requirements of the National Emission Standards for Hazardous Air Pollutants through programs to monitor radionuclide emissions, evaluate dose to nearby residences, and report doses annually to the EPA. Proposed new sources of emissions at INEEL and modifications are evaluated to identify the expected contribution to dose to nearby residents. If specified levels (fractions of the acceptable dose for combined site operations) are exceeded, a National Emission Standards for Hazardous Air Pollutants permit application is prepared for submittal to the EPA. New sources are also evaluated to determine emissions monitoring requirements. The INEEL currently holds more than 25 National Emission Standards for Hazardous Air Pollutants permits granted by the EPA.

In addition to radionuclides, emissions standards have been established under the National Emission Standards for Hazardous Air Pollutants Program for several nonradiological hazardous air pollutants, including benzene, asbestos, and others. The INEEL complies with the requirements for evaluation, control, and permitting of nonradiological hazardous air pollutants through programs that are also administered by EPA. In accordance with Title III of the 1990 Amendments to the Clean Air Act, maximum achievable control technology will be specified by the EPA for various source categories. Maximum achievable control technology will require a level of control at least as stringent as the best performing (i.e., best controlled) sources within each source category. Sources will be required to implement programs or controls to comply with the maximum achievable control technology by the scheduled implementation date. Several maximum achievable control technology standards have been promulgated or proposed. Proposed maximum achievable control technology emission standards and work practice requirements associated with combustion of hazardous waste were issued May 2, 1997 (62 FR 24212). These will apply to certain waste processing facilities, including the New Waste Calcining Facility and other facilities that include thermal treatment processes. Emissions from waste processing facilities covered by the maximum achievable control technology regulation were assumed to meet the May 1997 proposed emissions standards, which are presented in Table C.2-3. EPA recently finalized the maximum achievable control technology rule for hazardous waste combustion facilities (64 FR 52827; September 30, 1999). The final emissions standards for several hazardous air pollutants were modified from the levels EPA proposed in May 1997.

**Table C.2-3.** Proposed maximum achievable control technology standards for combustion of hazardous waste.

| Hazardous air pollutant or surrogate | Proposed standard[a] |
|---|---|
| Dioxins and furans (nanograms per dry standard cubic meter, as 2,3,7,8-TCDD equivalent) | 0.20 |
| Mercury (micrograms per dry standard cubic meter) | 40 |
| Particulate matter[b] (milligrams per dry standard cubic meter) | 34 |
| Hydrogen chloride and chlorine (parts per million by volume as hydrogen chloride equivalents) | 75 |
| Semi-volatile metals (total lead and cadmium; micrograms per dry standard cubic meter) | 100 |
| Low-volatile metals (total antimony, arsenic, beryllium, and chromium; micrograms per dry standard cubic meter) | 55 |
| Carbon monoxide[c] (parts per million by volume) | 100 |
| Hydrocarbons[c] (parts per million by volume, as propane) | 10 |

TCDD = Tetrachlorodibenzo-P-Dioxin.

a. All maximum achievable control technology concentrations are based on dry, standard conditions corrected to 7 percent oxygen.

b. Particulate matter is specified as a surrogate for control of non-mercury metals.

c. Pollutants are specified as surrogate indicators of good combustion control.

It is also expected that additional INEEL air emissions sources will be assigned maximum achievable control technology requirements as standards are promulgated for additional source categories, including (but not limited to) waste treatment, storage, and disposal facilities; research and development activities; industrial boiler; process heater; stationary internal combustion engine; and site remediation activities.

### C.2.2.4 State of Idaho Permit Programs

The Idaho Air Pollution Control Program, administered by the Division of Environmental Quality, requires that permits be obtained for potential sources of air pollutants. Unless the source is specifically exempt from permitting requirements, Permits to Construct and Operate must be obtained before a source can be constructed or operated. The permits specify requirements, such as monitoring, reporting and recordkeeping, or limitations on operating conditions, such as emission limits. The list of equipment or operations which are exempt from permit requirements is very specific and limited; most new INEEL sources and modifications to existing sources are subject to permit requirements.

In addition to individual source permits, the INEEL is also required to obtain a sitewide Title V operating permit, as stipulated under the 1990 Clean Air Act Amendments, which must be renewed periodically. The INEEL submitted an application for a Title V Operating Permit in July 1995. Permits are typically issued with specific emissions limits and conditions for operation. This formal permitting process allows the State to determine that emissions will be adequately controlled, the source will comply with all emission standards and regulations, and public health and safety will be adequately protected. Generally, Operating Permit reviews must go through a public review period with an opportunity for public comment. The maximum achievable control technology program (Title III of the 1990 Clean Air Act Amendments which is discussed above) will be administered under the Title V program and also allow for public review and comment.

### C.2.2.5 State of Idaho Rules for Toxic Air Pollutants

The Idaho Division of Environmental Quality has promulgated rules and methodologies to estimate and control the potential human health impacts of toxic air pollutants (pollutants which by their nature are toxic to human or animal life or vegetation) from new or modified sources. The method used to assess cancer health risk associated with air emissions from current INEEL facilities and proposed Advanced Mixed Waste Treatment Project alternatives is summarized in Appendix E-4, Health and Safety. These rules are contained in Title 1, Chapter 1, Sections 585 and 586 of the Rules for the Control of Air Pollution in Idaho (IDHW 1997) and are implemented through the air quality permit program described above. Threshold emission levels have been established for about 700 toxic air pollutants, based on the known or suspected toxicity of these substances. Expected (uncontrolled) emissions above these screening thresholds must be evaluated using standard air dispersion modeling techniques and risk assessment methodologies to assess potential impacts. A facility will not be granted a permit unless it can be shown that the emissions will comply with all applicable toxic air pollutant increments for carcinogenic (cancer-causing) and noncarcinogenic substances (IDHW 1997). As part of the permit evaluation process, requirements related to toxic air pollution control equipment, facility modifications, and materials substitutions may be specified to limit ambient levels of toxic air pollutants.

The State has defined acceptable ambient concentration levels for many toxic air pollutants, including both carcinogenic and noncarcinogenic contaminants. These levels are increments over existing levels and apply only to sources that became operational after May 1, 1994. For contaminants known or suspected to cause cancer in humans, this level has been defined as the acceptable ambient concentration for a carcinogen. The acceptable ambient concentration for a carcinogen is based on risk and corresponds to that concentration at which the probability of contracting cancer is one in a million, assuming continuous exposure over a 70-year lifetime. This probability is often described as an "individual excess cancer risk." Excess, in the sense used here, means above the normal cancer incidence rate, which is currently about one in three for the U.S. population. An individual excess cancer risk of one in a million or less is generally considered an acceptable level of risk. The acceptable ambient concentration for a carcinogen differs for each carcinogenic substance due to its carcinogenic potency, as defined by the EPA. The State will grant a permit if the calculated incremental risk due to project emissions does not exceed the acceptable ambient concentration for a carcinogen (that is, does not result in an individual excess cancer risk greater than one in a million). If this level is expected to be exceeded, a permit may still be granted if (a) the calculated risk does not exceed ten in a million and (b) toxic reasonably achievable control technology (which is similar to best available control technology) is employed to limit emissions of carcinogenic substances.

Many air contaminants do not cause cancer but may contribute to other health impacts, such as respiratory or eye irritants, or impacts to the cardiovascular, reproductive, central nervous or other body systems. Levels of significance for noncarcinogenic substances are called acceptable ambient concentrations. Acceptable ambient concentrations are assigned for each of the listed non-carcinogenic toxic air pollutants based on acceptable exposure limits for occupational workers and other reference sources of information for the contaminant in question. For an added margin of safety, the State generally sets the acceptable ambient concentration at one-hundredth of the acceptable occupational exposure level. Permits are granted if incremental emissions from the new or modified source are expected to result in annual average concentrations below the acceptable ambient concentrations. However, if the acceptable ambient concentrations are expected to be exceeded, a permit may still be granted based on consideration of other factors, such as the toxicity of the substance and anticipated level of exposure.

### C.2.2.6 Standards for Hazardous Waste and Toxic Substance Control

In addition to regulations designed specifically for air resource protection, projects which include handling or treatment of hazardous substances are required to comply with various Federal and State environmental regulatory programs, which incorporate certain requirements on releases to air. Among the most important of these requirements for hazardous waste incineration are the standards for the destruction of organic hazardous constituents in solid wastes prescribed by EPA and IDAPA 16.01.05.008 (40 CFR 264 Subpart O) (IDHW 1997). Polychlorinated biphenyl incineration must achieve the minimum 99.9999 percent destruction and removal efficiency of the Toxic Substances Control Act, while incineration of other difficult-to-destroy compounds, such as chlorobenzene and carbon tetrachloride, must achieve a minimum 99.99 percent destruction and removal efficiency. RCRA performance standards for hydrogen chloride emissions in IDAPA 16.01.05.008 require either 99 percent hydrogen chloride removal or less than 4 pounds per hour hydrogen chloride emission rate during the incineration of chlorinated wastes.

### C.2.2.7 U.S. Department of Energy Orders and Guides

The DOE has developed and issued a series of orders and guides to ensure that all operations comply with applicable environmental, safety, and health regulations and DOE internal policies, including the concept of maintaining emissions and exposures to the public and workers at levels that are as low as reasonably achievable. The as low as reasonably achievable concept is employed in the design and operation of all facilities and applies to all types of air pollutants (for example, radionuclides, carcinogens, toxic and criteria air pollutants).

## C.2.3 AIR QUALITY IMPACT ASSESSMENT METHODOLOGY

Several distinct types of evaluations have been performed to assess air quality for existing conditions and future actions. These are:

- Radiological air quality assessments, which are performed for radionuclide emissions from stationary sources

- Nonradiological air quality assessments, which are performed for criteria and toxic air pollutant emissions from stationary (stack and diffuse) operational sources

- Degradation of visibility assessments, which are performed for certain criteria emissions from stationary sources
- Fugitive dust and combustion product emissions associated with construction equipment and some operational sources
- Assessments of criteria pollutant emissions from mobile sources.

This section describes the methodology used in each type of air quality assessment, including the general approach to source term estimation and atmospheric dispersion modeling, and specific information on related assumptions, methods, and data used in the analyses.

### C.2.3.1 Source Term Estimation

The type and quantity of pollutants emitted to air from a specific source, or group of sources, is often referred to as the source term. The baseline source term was compiled from INEEL emissions inventory reports (DOE 1996b, 1997b) and National Emission Standards for Hazardous Air Pollutants reports (DOE 1996a, 1997a), with projected increases as described in the SNF & INEL EIS (Section 5-7, and Appendix F-3). The source term for each of the proposed waste processing alternatives was developed using information contained in the project data summaries and supporting documentation. Emission rates were calculated for each project, and these were compiled, evaluated, and processed for use in dispersion modeling. The assumptions and methods used for specific project emission rate calculations are documented in the engineering data files which have been prepared to support each individual project. Emission rates for each alternative were determined by summing the emission rates for each project associated with that alternative. In the case of the waste processing alternatives, all facilities were assumed to operate concurrently. For some decommissioning activities, however, some corrections were applied to account for the fact that closure activities were sequential.

**Process Emissions**

The project data sheets and supporting documentation contain estimates of radionuclide and nonradiological pollutant emission rates for those projects that include waste handling or processing. DOE estimated these emissions for each project based on the nature of the process and the composition of process materials. The estimation method includes assumptions regarding the amount of material that could enter the process exhaust and the amount that would pass through air pollution control systems and be released to the atmosphere. Where applicable, release estimates relied on experience with facilities or processes similar to the one being evaluated.

The primary data source for radionuclide emissions from principal waste processing facilities is a report by McDonald (1999). For radionuclides other than tritium, release estimates are based on actual emissions released from existing waste processing facilities at INTEC. Emissions released during 1996 (a year in which no calcining was performed) from the waste evaporator and fractionator were used as a basis for estimating emissions from the following projects associated with proposed waste processing alternatives:

- Newly Generated Liquid Waste and Tank Farm Heel Waste Management
- Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility
- No Action Alternative.

For proposed alternatives which involve calcination, emissions are patterned after releases from the INTEC main stack during 1997 (a year in which calcining was performed). The specific projects covered by this estimation method are:

- Calcining SBW including New Waste Calcining Facility Upgrades
- Vitrification of Separated High-Activity Waste
- Denitration and Grouting of Low-Activity, Class A Waste
- Denitration and Grouting of Low-Activity, Class C Waste
- Vitrification of Calcine and SBW.

For these projects, DOE calculated emissions by multiplying the concentration of radionuclides in the 1997 offgas by the annual volume of gas that each of the proposed projects would discharge.

DOE estimated tritium emissions by dividing the current inventory of tritium in SBW (the only waste stream with a significant quantity of tritium) by the number of years that a thermal waste process would be applied to that waste.

For projects other than those listed above, DOE estimated building emissions using a general method based on the assumption that the primary radionuclides in building exhaust are present in the same proportion as in calcine or tank waste (whichever is more appropriate). The total activity is assumed for dose assessment purposes to be divided among strontium-90, cesium-137, and plutonium-239 according to the following:

| Radionuclide | Fraction of total activity | |
|---|---|---|
| | Calcine | Tank waste |
| Strontium-90 | 0.90 | 0.49 |
| Cesium-137 | 0.10 | 0.51 |
| Plutonium-239 | $2.6 \times 10^{-5}$ | $3.3 \times 10^{-3}$ |

It was further assumed that for general building ventilation, these radionuclides are present at a concentration of 1 percent of the derived air concentration, which is a limit for radionuclide concentration specified in 10 CFR 835. This general method was used for estimating emissions in general building ventilation during facility operation and dispositioning, as well as for processes associated with projects other than those specified above. This latter category includes projects such as Calcine Retrieval and Transport, Mixing and Hot Isostatic Pressing, and the Direct Cement Process.

Estimates of nonradiological air pollutant releases from thermal waste treatment processes have been performed by Kimmitt (1998) using release data previously developed by Abbott et al. (1999). These estimates are consistent with EPA guidance (EPA 1994) and are based on the following factors:

- Contaminant concentrations in the waste
- Formation of products of incomplete combustion (such as dioxins and furans)
- Material flow rates
- Air pollution control system performance.

Since little data are available on contaminant levels in the waste to be treated (for example, organic content of calcine), DOE assumed that up to 5 percent of the organic contaminants in the original liquid HLW are retained in the calcine. The performance of air pollution control systems is based on vendor data and technical literature sources.

**Fossil Fuel Combustion By-products**

DOE estimated criteria and toxic air pollutant emissions associated with fossil fuel combustion for each project. These emission rates are based on the amount of fossil fuel that would be burned to produce an amount of steam required by the project for process use and building heating and air conditioning. A similar method was used to estimate emission from diesel fuel-burning equipment (cranes, loaders, haulers, etc.) that would be required to support project construction, operation, and decontamination and decommissioning at the end of its useful life. These calculations are documented in the Project Data Sheets for each project. In addition to the criteria pollutant emissions documented in the Project Data Sheets, the air resource assessment estimated toxic air pollutant emission rates associated with assumed fuel oil combustion rates. These estimates are based on the EPA-recommended emission factors [specified in EPA (1998)] for residual oil-fired boilers. Table C.2-4 presents the emission factors used for nonradiological pollutant releases from fuel oil combustion.

**Radionuclide and Toxic Emission Screening**

Numerous radionuclides or nonradiological toxic air pollutants could be present in airborne effluents from facilities associated with the waste processing alternatives. Typically, however, relatively few substances contribute significantly to the risk. DOE performed screening evaluations to identify the most significant substances, based on substance toxicity and emission rates, in an attempt to reduce the number of individual pollutants to be quantitatively assessed for impacts. The radionuclide screening was based on a screening factor ($SF_{eff}$) which is the product of the estimated radionuclide emission rate ($Q_,$ in curies per year) and an effective dose factor ($DF_{eff}$). The dose factors consider all important exposure pathways (inhalation, ingestion and external exposure) and were obtained from National Council on Radiation Protection Report No. 123 II, "Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground – Work Sheets" (NCRP 1996). Thus, for each radionuclide i:

$$SF_{eff,i} = Q_i \times DF_{eff,i}$$

The radionuclides which collectively accounted for a nominal 99 percent of the effective dose were retained for release modeling and dose assessment.

The inclusion of specific toxic air pollutants in emissions estimates is based on the guidance provided in EPA (1994). The process for selection and characterization of toxics is documented in Abbott et al. (1999).

**Fugitive Dust Generation**

DOE estimated the amount of fugitive dust generated from construction of facilities based on the area of land that would be disturbed. The total amount of fugitive dust is estimated using the EPA-recommended factor of 1.2 tons per acre disturbed for each month of construction (EPA 1998). This same factor was

used to estimate dust generation from dispositioning facilities. In most cases, it was conservatively assumed that construction and dispositioning would persist for 12 months per year; however, some activities related to Tank Farm and bin set dispositioning assume that dust-generating activities would occur for only 6 months per year.

### C.2.3.2 Radiological Assessment Methodology

This section summarizes information on the data and methods used to assess radiological conditions and dose to individuals at onsite and offsite locations due to routine emissions of radionuclides from existing and proposed INEEL facilities.

**Model Selection and Application**

The computer program GENII, Version 1.485 3-Dec-90 (Napier et al. 1988), was used to calculate doses from all pathways and modes of exposure likely to contribute significantly to the total dose from airborne releases. These are:

- External radiation dose from radionuclides in air
- External dose from radionuclides deposited on ground surfaces
- Internal dose from inhalation of airborne radionuclides
- Internal dose from ingestion of contaminated food products.

GENII incorporates algorithms, data, and methods for calculating doses to various tissues and organs and for determination of effective dose equivalent, based on the recommendations of the International Commission on Radiological Protection, as contained in Publications 26 and 30 (ICRP 1977, 1979). It should be noted that newer weighting factors for determination of effective dose are available in International Commission on Radiation Protection Publication 60 (ICRP 1991); however, International Commission on Radiation Protection 26/30 weighting factors are used here since these still form the basis for Federal regulations and DOE Orders (e.g., 10 CFR 20, 10 CFR 834, etc.). The newer weighting factors of International Commission on Radiation Protection 60 have not yet been adopted for use in the U.S., since their use would require a number of adjustments to existing regulations. Also, as pointed out in the Preface to Federal Guidance Report 12 (EPA 1993), for most radionuclides these dose coefficients are not very sensitive to the choice of weighting factors.

The GENII model has several technical advantages over other available methods, including the ability to assess dose from many different release scenarios and exposure pathways. In addition, it conforms to the strict quality assurance requirements of Quality Assurance Program Requirements for Nuclear Facilities [ASME (1989), Basic Requirement 3 (Design Control) and Supplementary Requirement 3S-1 (Supplementary Requirements of Design Control)], which includes requirements for verification and validation of computer codes.

**Release Modeling**

Releases from stacks or vents may be modeled as either elevated or ground-level releases. For this EIS, the decision whether to model a given emission point as a stack or ground-level release was based on guidance issued by the EPA (EPA 1995a). This guidance is used by the INEEL in the dose assessments performed annually to assess compliance with the National Emission Standards for Hazardous Air Pollutants dose limit. In general, if the height of the release point is less than or equal to 2.5 times the height of attached or nearby buildings, turbulent (wake and downwash) effects are assumed to influence the release, effectively lowering the release height to ground level. In some cases, stacks at existing facilities were modeled as individual release points; in other cases, sources were grouped together and treated as a single release point. For example, in the baseline modeling, elevated sources at the Power Burst Facility (the Waste Experimental Reduction Facility North and South Stacks and the Power Burst Facility Stack) were modeled as individual elevated releases. Conversely, effluents from various vents at the Naval Reactors Facility were summed and treated as a single ground-level release.

The stack design for many of the proposed waste processing facilities are preliminary; however, it can be assumed that these stacks would conform to "good engineering practice" and would be tall enough to provide good dispersion. The stack parameters used for waste processing facility modeling are presented in Table C.2-5.

**Meteorological Data**

The atmospheric transport modeling performed as part of these radiological assessments was based on actual meteorological conditions measured at eight different locations at INEEL. In particular, the data files prepared for these assessments were derived from observations at INEEL weather stations over the period 1987 through 1991. Radionuclide emissions from those current or proposed facilities at INTEC having tall stacks were modeled using meteorological data from the 200-foot (61-meter) level of the Grid III monitoring station, which is located about 1.5 kilometers north of INTEC. These data are presented in a format specifically prepared for the radiological impact assessment modeling as a joint

frequency distribution of wind speed, direction, and atmospheric stability class in Table C.2-6. The data set shows the percent of time that the wind is blowing toward specific compass directions (S, SSW, SW, etc.), grouped first by atmospheric stability category and then by wind speed group. Meteorological data sets used in the baseline dose assessments for existing facilities are documented in DOE (1996a, 1997a). Meteorological data sets used in the dose assessments for future facilities not associated with waste processing alternatives are documented in Leonard (1992).

**Receptor Locations**

Doses were assessed for individuals located at the onsite and offsite locations of highest predicted dose and for the surrounding population, as described below.

**Maximally-Exposed Individual.** The offsite individual whose assumed location and habits are likely to result in the highest dose is referred to as the maximally-exposed individual. The location of the maximally-exposed individual was identified on the basis of the source-receptor distance and direction combination that yielded the highest predicted offsite dose. In the SNF & INEL EIS, radiation dose was calculated for the minimum distance from each of the major INEEL source areas to the site boundary for each of the 16 compass directions. Since this location was assessed separately for emissions from each of the major INEEL facility areas, the maximally-exposed individual receptor locations are merely points on the INEEL boundary and do not correspond to any actual residences or quarters. The maximum impacts at these points were conservatively summed to derive cumulative impacts, without consideration of the fact that the maximum impact points may be spatially separated. The actual maximally-exposed individual locations for five of the eight major INEEL facility areas (INTEC, Central Facilities Area, Radioactive Waste Management Complex, Power Burst Facility/Waste Experimental Reduction Facility, and Test Reactor Area) are all located along a segment of the southern boundary; the maximally-exposed individual locations for Naval Reactors Facility, Argonne National Laboratory-West, and Test Area North are all distantly located. Although unrealistic, this summation process served to establish the upper-bounding dose. Despite the inherent conservatism, the results obtained were low; further resolution of the actual maximally-exposed individual location and dose was not necessary.

In this EIS, the dose to the maximally-exposed individual from existing facilities (i.e., the baseline case) is taken from the annual National Emission Standards for Hazardous Air Pollutants compliance evaluations (DOE 1996a, 1997a). The highest values of the most recent two years during which no

**Table C.2-6.** Joint frequency distribution data set from the 61-meter level of the INEEL Grid III monitoring station for use in radiological impact assessment modeling.

INEL Grid III 61 M Level - 1987-1991

7 6 1 1 61.0[a]

1.04 2.46 4.47 6.93 9.61 13.19 19.00[b]

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.21 | 0.34 | 0.31 | 0.23 | 0.22 | 0.20 | 0.26 | 0.23 | 0.19 | 0.17 | 0.12 | 0.12 | 0.10 | 0.12 | 0.09 | 0.17 |
| 0.04 | 0.06 | 0.03 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.03 | 0.02 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 |
| 0.04 | 0.07 | 0.07 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 0.17 | 0.29 | 0.17 | 0.09 | 0.03 | 0.06 | 0.05 | 0.08 | 0.08 | 0.08 | 0.05 | 0.05 | 0.06 | 0.06 | 0.05 | 0.10 |
| 0.16 | 0.19 | 0.17 | 0.09 | 0.07 | 0.08 | 0.04 | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 | 0.05 | 0.05 | 0.07 | 0.07 |
| 0.44 | 0.51 | 0.49 | 0.33 | 0.25 | 0.22 | 0.18 | 0.20 | 0.15 | 0.17 | 0.17 | 0.17 | 0.18 | 0.17 | 0.20 | 0.30 |
| 0.25 | 0.45 | 0.58 | 0.49 | 0.40 | 0.34 | 0.31 | 0.49 | 0.63 | 0.66 | 0.57 | 0.32 | 0.24 | 0.14 | 0.18 | 0.18 |
| 0.06 | 0.18 | 0.21 | 0.11 | 0.03 | 0.02 | 0.02 | 0.05 | 0.08 | 0.12 | 0.08 | 0.05 | 0.03 | 0.01 | 0.01 | 0.02 |
| 0.15 | 0.35 | 0.40 | 0.09 | 0.02 | 0.01 | 0.02 | 0.05 | 0.11 | 0.10 | 0.12 | 0.03 | 0.04 | 0.02 | 0.01 | 0.03 |
| 0.55 | 1.78 | 1.05 | 0.20 | 0.07 | 0.04 | 0.08 | 0.10 | 0.17 | 0.30 | 0.32 | 0.20 | 0.10 | 0.07 | 0.08 | 0.12 |
| 0.32 | 0.75 | 0.52 | 0.15 | 0.07 | 0.04 | 0.06 | 0.09 | 0.09 | 0.17 | 0.15 | 0.18 | 0.07 | 0.06 | 0.07 | 0.09 |
| 0.77 | 1.65 | 1.38 | 0.67 | 0.34 | 0.24 | 0.21 | 0.27 | 0.31 | 0.51 | 0.47 | 0.48 | 0.35 | 0.32 | 0.34 | 0.38 |
| 0.02 | 0.05 | 0.05 | 0.03 | 0.02 | 0.01 | 0.02 | 0.04 | 0.08 | 0.10 | 0.09 | 0.08 | 0.02 | 0.02 | 0.02 | 0.01 |
| 0.07 | 0.12 | 0.16 | 0.09 | 0.04 | 0.03 | 0.04 | 0.12 | 0.20 | 0.39 | 0.40 | 0.20 | 0.10 | 0.05 | 0.08 | 0.06 |
| 0.07 | 0.19 | 0.33 | 0.13 | 0.02 | 0.02 | 0.02 | 0.08 | 0.14 | 0.33 | 0.58 | 0.21 | 0.07 | 0.05 | 0.03 | 0.06 |
| 0.45 | 2.59 | 2.36 | 0.33 | 0.07 | 0.05 | 0.08 | 0.22 | 0.36 | 0.91 | 1.18 | 0.70 | 0.22 | 0.12 | 0.12 | 0.21 |
| 0.34 | 1.26 | 0.93 | 0.17 | 0.04 | 0.03 | 0.06 | 0.11 | 0.21 | 0.34 | 0.49 | 0.38 | 0.15 | 0.08 | 0.12 | 0.17 |
| 0.35 | 1.20 | 1.25 | 0.37 | 0.12 | 0.06 | 0.04 | 0.15 | 0.17 | 0.33 | 0.43 | 0.34 | 0.18 | 0.08 | 0.12 | 0.16 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.06 | 0.07 | 0.08 | 0.03 | 0.02 | 0.01 | 0.02 | 0.07 | 0.10 | 0.23 | 0.46 | 0.27 | 0.10 | 0.04 | 0.05 | 0.04 |
| 0.67 | 1.47 | 1.60 | 0.35 | 0.06 | 0.03 | 0.08 | 0.26 | 0.40 | 1.28 | 2.95 | 1.78 | 0.44 | 0.16 | 0.08 | 0.40 |
| 0.15 | 0.80 | 0.80 | 0.16 | 0.03 | 0.01 | 0.06 | 0.13 | 0.13 | 0.33 | 0.88 | 0.69 | 0.11 | 0.02 | 0.01 | 0.08 |
| 0.05 | 0.20 | 0.25 | 0.07 | 0.01 | 0.01 | 0.00 | 0.02 | 0.02 | 0.01 | 0.10 | 0.11 | 0.01 | 0.01 | 0.00 | 0.01 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 |
| 0.64 | 0.61 | 0.74 | 0.16 | 0.02 | 0.01 | 0.04 | 0.16 | 0.29 | 1.10 | 3.53 | 1.98 | 0.38 | 0.12 | 0.07 | 0.26 |
| 0.03 | 0.12 | 0.17 | 0.07 | 0.00 | 0.00 | 0.01 | 0.03 | 0.03 | 0.06 | 0.37 | 0.28 | 0.04 | 0.01 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.25 | 0.25 | 0.18 | 0.05 | 0.00 | 0.00 | 0.02 | 0.08 | 0.16 | 0.55 | 2.88 | 2.13 | 0.18 | 0.11 | 0.01 | 0.05 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.01 | 0.05 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.47 | 0.48 | 0.01 | 0.01 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

a. Starting from left, these values indicate the number of wind speed data groups in the file, number of atmospheric stability data groups in file, number of seasonal data groups in file, number of time-of-day data groups in file, and the height (in meters) at which the joint frequency data applies.

b. These values represent the average wind speed for each wind speed group, in meters per second.

calcining was performed is used. The dose from reasonably foreseeable projects is assumed to be represented by the dose calculated for the SNF & INEL Preferred Alternative (modified as described below) and the Advanced Mixed Waste Treatment Project.

The maximally-exposed individual dose from emissions associated with waste processing or facilities disposition alternatives was modeled using GENII, and then added to the baseline dose and projected increases to determine the cumulative offsite maximally-exposed individual dose.

**Population Dose.** Population dose is not assessed annually as part of the National Emission Standards for Hazardous Air Pollutants assessment, so the baseline dose for this EIS is based on assessments performed for the SNF & INEL EIS. In the SNF & INEL EIS, dose was assessed for the collective population residing in a circular area defined by a radius of 50 miles extending out from each major INEEL facility. Population data used were based on 1990 census data provided by the U.S. Census Bureau. For projects associated with SNF & INEL EIS alternatives and projects expected to become operational before June 1, 1995, growth projections for the counties surrounding INEEL were applied. These growth estimates are approximately 10 percent per decade. The period covered by the SNF & INEL EIS analysis extends to the year 2010, and the population doses reported in Section 5.7, Air Resources, of Volume 2 of that EIS are the highest obtained for any year throughout this period.

For this EIS, the population dose assessment applies only to the population residing within 80 kilometers of the INTEC, where waste processing and facilities disposition alternatives are proposed to be implemented. The distribution of this population by distance and direction from INTEC, based on 1990 census data, is presented in Table C.2-7. A correction factor of 1.7 (equivalent to an annual growth rate of about 1.25 percent) was then applied to this population dose assessment to account for anticipated population growth over the period 1990 to approximately 2030.

**Noninvolved INEEL Worker.** INEEL workers may be exposed to radiation attributable to INEEL sources both as a direct result of job performance (such as work within a radiologically controlled area) and incidentally (such as from airborne releases from facilities within their work area, as well as more distant sources within the INEEL). Direct job-related occupational exposure is beyond the scope of this section and is discussed in Sections 5.2.10 and 5.38 (Health and Safety) of this EIS. A worker incidentally exposed to onsite concentrations of radionuclides is referred to here as a “noninvolved worker.” Exposures to noninvolved workers were assessed in the SNF & INEL EIS (for existing sources and future projects) and in this EIS (for proposed waste processing and facilities disposition alternatives).

The dose to the maximally-exposed noninvolved worker was assessed using the general methodology described in previous sections. However, worker dose calculations did not include the food ingestion pathway (since workers do not consume food products grown onsite), and exposure times were reduced to reflect the amount of time a worker would spend onsite (assumed to be 2,000 hours per year). As in the case of the offsite maximally-exposed individual, the maximally-exposed worker dose actually applies to a location and not a real individual. It is conservatively assumed that any location within a major INEEL facility area could be occupied by a worker on a full-time basis (i.e., 2000 hours per year). Doses were assessed for locations within INTEC and at other areas likely to receive the highest exposure: namely, Central Facilities Area, Radioactive Waste Management Complex, and Test Reactor Area. In all cases, the highest modeled dose occurred at the Central Facilities Area.

**Baseline Dose and Cumulative Dose Determination**

DOE assessed cumulative radiological impacts by summing the doses from existing (baseline) sources, foreseeable increases to the baseline, and doses associated with alternatives. The bases used to estimate baseline doses and foreseeable increases are described below and summarized in Table C.2-8.

**Maximally-Exposed Individual.** The baseline dose is determined from the 1996 National Emission Standards for Hazardous Air Pollutants evaluation as described above. It is assumed that the annual dose calculated for the SNF & INEL EIS Preferred Alternative and the Advanced Mixed Waste Treatment Project represents foreseeable increases to the baseline. However, the SNF & INEL EIS dose was modified to (a) eliminate the dose contributions that are from facilities that are no longer planned, are located at Test Area North, or are assessed under the waste processing impacts, and (b) add the dose contributions from the proposed Advanced Mixed Waste Treatment Project Preferred Alternative (Micoencapsulation Option). This results in a baseline dose of 0.031 millirem per year and a foreseeable increase of 0.13 millirem per year, resulting in a total baseline dose of 0.16 millirem per year.

**Population Dose.** The SNF & INEL EIS annual dose from existing sources and increases that were foreseeable at the time the analysis was performed was 0.32 person-rem, and the Preferred Alternative dose was 2.6 person-rem per year. The Idaho Waste Processing Facility (a conceptual facility which has since been replaced by the Advanced Mixed Waste Treatment Project) accounted for more than half of this dose. In addition to project-related modifications, the baseline population dose is also multiplied by 1.3 to account for estimated population growth between roughly 2010 and 2030. Upon modification, the maximum annual baseline population dose becomes 0.92 person-rem.

**Table C.2-8.** Calculation of total baseline dose used in cumulative dose determinations.

| Category | Value | Basis |
|---|---|---|
| **Offsite maximally-exposed individual dose in millirem per year** | | |
| Baseline | 0.031 | 1996 National Emission Standards for Hazardous Air Pollutants dose assessment |
| Increases | 0.58 | SNF & INEL EIS Preferred Alternative |
| Modifications | -0.018 | Waste Immobilization Facility |
| | -0.42 | Idaho Waste Processing Facility |
| | -0.029 | Waste Experimental Reduction Facility (incineration) |
| | -0.004 | Facilities at Test Area North |
| | 0.022 | AMWTP Proposed Action (Microencapsulation Option) |
| Total baseline plus increases | 0.16 | |
| **Noninvolved worker dose in millirem per year** | | |
| Baseline | 0.32 | SNF & INEL EIS Table 5.7-4 |
| Increases | 0.140 | SNF & INEL EIS Preferred Alternative |
| Modifications | 0.058 | AMWTP Proposed Action (Microencapsulation Option) |
| | -0.0001 | Waste Immobilization Facility |
| | -0.11 | Idaho Waste Processing Facility |
| | -0.11 | Waste Experimental Reduction Facility (compacting and sizing) |
| | -0.007 | Waste Experimental Reduction Facility (incineration) |
| Total baseline plus increases | 0.29 | |
| **Population dose in person-rem per year** | | |
| Baseline | 0.32 | SNF & INEL EIS Table 5.7-4 |
| Increases | 2.6 | SNF & INEL EIS Preferred Alternative |
| Modifications | -0.097 | Waste Immobilization Facility |
| | -1.6 | Idaho Waste Processing Facility |
| | -0.2 | Waste Experimental Reduction Facility (compacting and sizing) |
| | -0.230 | Waste Experimental Reduction Facility (incineration) |
| | -0.097 | Waste Immobilization Facility |
| | 0.009 | AMWTP Proposed Action (Microencapsulation Option) |
| Total baseline plus increases | 0.705 | |
| | 1.3 | Factor for population growth between 2010 and 2030 |
| Modified baseline dose | 0.92 | |

AMWTP = Advanced Mixed Waste Treatment Project.

**Noninvolved INEEL Worker.** The SNF & INEL EIS annual baseline dose for the maximally-exposed non-involved worker was 0.32 millirem and occurred at the Test Reactor Area. The maximum annual dose from the SNF & INEL EIS Preferred Alternative was 0.14 millirem and occurred at Central Facilities Area. Since DOE has determined that the maximum onsite dose from INTEC emission sources occurs at the Central Facilities Area, this EIS conservatively assumes that the baseline and Preferred Alternative dose cited above both occur in that area. Upon modification, the baseline noninvolved worker dose is 0.29 millirem per year.

### C.2.3.3 Nonradiological Assessment Methodology

Air pollutant levels have been estimated by application of air dispersion computer models that incorporate mathematical functions to simulate transport of pollutants in the atmosphere. The modeling methodology conforms to that recommended by the EPA (EPA 1995a) and the State of Idaho (IDHW 1997) for such applications. The models and application methodology are designed to be conservative; that is, they employ data and algorithms designed to prevent underestimating the pollutant concentrations that would actually exist. In general, the methods used to assess consequences of proposed actions were identical to those used in the baseline assessments. Minor exceptions (such as the use of refined versus screening-level modeling) are noted where applicable. The primary objective of the assessments is to estimate nonradiological pollutant concentrations and other impacts in a manner that facilitates comparison between alternative courses of action, while also providing a measure of maximum potential impact and an indication of compliance with applicable standards or guidelines. The types of pollutants assessed include the criteria pollutants and toxic air pollutants.

Criteria pollutant concentrations were estimated for locations and over periods of time corresponding to State of Idaho and National Ambient Air Quality Standards. Since these standards apply only to ambient air (that is, locations to which the general public has access), criteria pollutant concentrations were assessed for offsite locations and public roads traversing the INEEL. DOE did not quantitatively assess impacts related to ozone formation, although emissions of volatile organic compounds (which are precursors to ozone formation) were evaluated. EPA and Idaho Department of Health and Welfare are not aware of any simple, well-defined method to assess ozone formation potential, and ozone levels in the region are not generally recognized as problematic. This has been confirmed by recent data collected by the National Park Service at Craters of the Moon National Monument where no exceedances of the primary ozone standard have been reported (DOI 1994).

Offsite levels of carcinogenic air pollutants were evaluated on the basis of annual average emission rates and compared to annual average standards (increments) specified by the State of Idaho (IDHW 1997). For noncarcinogenic toxic air pollutants, DOE estimated maximum 24-hour levels at both offsite and public road locations and compared the results to applicable noncarcinogenic standards (IDHW 1997). Toxic air pollutants were also assessed for onsite locations because of potential worker exposure to these hazardous substances. Onsite levels of specific toxins were calculated using maximum hourly emission rates and compared to occupational exposure limits set for these substances by either the Occupational

Safety and Health Administration or the American Conference of Governmental Industrial Hygienists (the more restrictive of the two limits is used).

**Model Description and Application**

The EPA Industrial Source Complex-3 (ISCST-3, Version 96113) computer code (EPA 1995b) was the primary model used to evaluate impacts of waste processing alternatives. The ISC-3 model incorporates site-specific data (such as meteorological observations from INEEL weather stations), and takes into account effects such as stack tip downwash and turbulence induced by the presence of nearby structures. In addition, the model accommodates multiple sources and calculates concentrations for user-specified receptor locations. Concentrations were calculated over a range of durations, from 1-hour maximum values to annual averages. This allows for comparison of standards based on specific averaging times. In summary, dispersion modeling using ISC-3 allows for a reasonable prediction of the impacts of proposed facilities and, therefore, is ideally suited for the comparative evaluation process used in this EIS.

The analyses performed for the SNF & INEL EIS which served to establish the bounding baseline conditions for this EIS made use of some additional models as described in Appendix F-3 of the SNF & INEL EIS. These models included an earlier version of ISC (ISC-2), and SCREEN, a screening-level model which was used in some cases where a source's contribution to toxic air pollutant concentrations was expected to be minimal (that is, well below acceptable standards). The EPA-recommended Fugitive Dust Model (Winges 1991) was used to assess fugitive dust impacts. SCREEN and the Fugitive Dust Model are not used in this EIS, as it was not necessary to repeat these analyses.

**Emission Parameters**

The use of air dispersion models requires emission parameters, such as stack height and diameter; exhaust gas temperature and flow rate; size of area (for example, disturbed areas related to construction sources); and pollutant emission rates. The SNF & INEL EIS analysis obtained emission parameter data from the INEEL air emissions inventories discussed above, as well as from project design documents.

As discussed in Section C.2.3.2, precise stack design information was not available for all facilities at the time the analysis was performed. However, DOE considers the data used (see Table C.2-5) to be representative of projected stack conditions, and modeling results based on these data to be valid for purposes of comparative analysis. For area sources such as ground-level emissions from diesel engine equipment, modeling was performed assuming a generic source with dimensions of 100 meters by 100 meters.

**Meteorological Data**

DOE modeled emissions from the existing or proposed facilities at INTEC using meteorological data from the Grid III monitoring station. Elevated (tall stack) releases were modeled using observations from the 61-meter (200-foot) level, while ground-level releases were modeled using data from the 10-meter level of the Grid III monitoring station. These meteorological data sets contain hourly observations of wind speed, direction, temperature, and stability class for the years 1991 and 1992.

Data required for the calculation of mixing height are currently being collected at INEEL but are not available for the 1991 through 1992 period; therefore, default mixing heights were used. For short-term assessments, a value of 150 meters, which represents the lowest value measured at INEEL, was used (DOE 1991). For annual average evaluations, 800 meters was used. This value has been calculated by the National Oceanographic and Atmospheric Administration and is recommended for use in dispersion modeling assessments (Sagendorf 1991). Evaluations were conducted using meteorological data from each of these years, and the highest of the predicted concentrations was selected.

**Receptor Locations**

The ISC-3 Model is capable of determining air quality impacts at receptor locations using either a grid layout pattern or user-specified receptor points. The receptor locations for the dispersion modeling were based on receptor arrays developed for the SNF & INEL EIS (described in Appendix F-3 of that document) and for other INEEL modeling applications. The main purpose of the array is to enable the identification of the point of maximum predicted impact and the quantification of pollutant levels at that location. The array developed for this EIS includes a portion of U.S. 20 as well as a grid that starts at the southwestern INEEL boundary and extends east for about 20 kilometers. The grid contains receptor points at 1,000-meter intervals and extends to a distance of 8 kilometers south of the boundary. The array also includes discrete receptor points at Big Southern Butte, Fort Hall Indian Reservation, and along the eastern and northern boundaries of Craters of the Moon Wilderness Area. The elevation of each receptor location has been included to better account for the effects of elevated terrain.

DOE calculated ambient air concentrations for each location specified in the receptor array; however, the regulatory compliance evaluations for carcinogenic toxic air pollutants were performed only for site boundary locations (and not transportation corridors), as provided by IDAPA 16.01.01.210.03.b (IDHW 1997). Criteria and noncarcinogenic toxic air pollutants were assessed at all ambient air locations. DOE also assessed Prevention of Significant Deterioration increment consumption for Class II ambient air locations in and around INEEL and Craters of the Moon Wilderness Area, the Class I area nearest the INEEL. Class I area increments were assessed at discrete receptor locations along the eastern and northern boundaries of Craters of the Moon Wilderness Area at intervals of 500 meters.

DOE also assessed onsite concentrations of toxic air pollutants for which occupational exposure limits have been established. Preliminary modeling was performed and the results were used with those of previous assessments (including those performed for SNF & INEL EIS) to identify the onsite areas of highest impact. The area of highest onsite nonradiological impact was found to be within INTEC. This differs from the radiological assessment, which determined that a worker at Central Facilities Area would receive the highest dose. Factors which contribute to this disparity include (a) differences in dispersion models; (b) 8-hour (nonradiological) vs. annual average (radiological) averaging time; and (c) differences in stack parameters for fossil fuel combustion facilities (nonradiological) and waste processing facilities (radiological). The INTEC dose assessment used a grid centered on the main stack and extending to the INTEC area boundary. This grid used closely-spaced (50 meters) receptor points to identify the onsite location of highest impact.

**Summation of Project Impacts**

The ISC-3 modeling results for individual sources were summed to determine total impacts by alternative. DOE performed this process as described below.

A modeling run was performed for each source group and each applicable averaging time, assuming an emission rate of one gram per second to produce atmospheric dispersion factors (X/Q) for each receptor location. The X/Q values were then imported into computer spreadsheets which processed the results by multiplying by estimated emission rates. The results for each source group comprising the alternative/option under evaluation were then summed, and the point of maximum concentration was identified. Cumulative projected impacts were characterized by adding actual 1996 INEEL emissions (corrected to eliminate INEEL sources that have since been permanently removed from service) to those of other foreseeable sources and the option under evaluation, and then determining the maximum resulting concentrations in the manner described above. DOE believes it is more appropriate to use the actual emissions baseline for this purpose than the maximum baseline case used in the SNF & INEL EIS (and described in Section 4.7 of this EIS). This is due to the fact that most of the criteria pollutant emissions associated with waste processing alternatives are produced by burning fossil fuel to produce steam, and the steam production rate would not be significantly greater than that currently experienced at INTEC.

DOE extended this process for summation of results for Prevention of Significant Deterioration increment consumption analyses. In this case, each source group associated with an alternative is assumed to be an “increment consuming” source (i.e., a source subject to Prevention of Significant Deterioration regulation). Modeling results for sources within each alternative/option were processed and summed in the same manner as described above. For cumulative Prevention of Significant Deterioration increment consumption impacts, however, DOE also performed modeling for all existing (baseline) sources which are subject to Prevention of Significant Deterioration regulation, and for foreseeable sources not associated with HLW management alternatives. The summation of modeling results was performed for each specific receptor location to determine the maximum value and identify the point of maximum concentration.

**Impacts on Visibility**

Atmospheric visibility has been specifically designated as an air quality-related value under the 1977 Prevention of Significant Deterioration Amendments to the Clean Air Act. Therefore, in the assessment of proposed projects that invoke Prevention of Significant Deterioration review (see Section C.2.2.2), potential impacts to visibility must be evaluated and shown to be acceptable in designated Class I areas and associated integral vistas. Craters of the Moon Wilderness Area, located approximately 20 miles southwest of the INTEC area (and about 12 miles from the nearest INEEL boundary), is the only Class I area in the Eastern Snake River Plain. However, recognizing the importance of the scenic views in and around the Fort Hall Indian Reservation, DOE performed additional analyses for this location.

The EPA has designed methodologies and developed computer codes to estimate potential visual impacts due to proposed emissions sources. The methodologies include three levels of sophistication. Level 1 is designed to be very conservative; it uses assumptions and simplifying methodologies that will predict plume visual impacts larger than those calculated with more realistic input and modeling assumptions. This conservatism is achieved by the use of worst-case meteorological conditions, including extremely stable (Class F) conditions coupled with a very low wind speed (1 meter per second) persisting for 12 hours, with a wind direction that would transport the plume directly adjacent to a hypothetical observer in the Class I or scenic area. The Level 1 analysis is implemented using the computer code VISCREEN to calculate the potential visual impact of a plume of specified emissions for the specified transport and dispersion conditions. If screening calculations using VISCREEN demonstrate that during worst-case meteorological conditions a plume is either imperceptible or, if perceptible, is not likely to be considered objectionable, further analysis of plume visual impact would not be required (EPA 1992). Level 2 visual impact modeling employs more site-specific information than that of Level 1. It is still conservative and designed to overestimate potential visibility deterioration. Level 3 visual impact modeling is even more intensive in scope and designed to provide a more realistic treatment of plume visual impacts. In both the SNF & INEL EIS and this EIS, DOE used Level 1 VISCREEN analyses to ensure conservatism.

Because within a range of wavelengths, a measure of contrast must recognize both intensity and perceived color, the VISCREEN model determines whether a plume would be visible by calculating contrast (brightness) and color contrast. Contrast is calculated at three visual wavelengths to characterize blue, green, and red regions of the visual spectrum to determine if a plume will be brighter, darker, or discolored compared to its viewing background. If plume contrast is positive, the plume is brighter than its viewing background; if negative, the plume is darker. To address the dimension of color as well as brightness, the color contrast parameter, termed “delta E,” is used as the primary basis for determining the perceptibility of plume visual impacts in screening analyses. Delta E provides a single measure of the difference between two arbitrary colors as perceived by humans. If contrasts are different at different wavelengths, the plume is discolored. If contrasts are all zero, the plume is indistinguishable from its background.

In order to determine whether a plume has the potential to be perceptible to observers under worst-case conditions, the VISCREEN model calculates both delta E and contrast for two assumed plume-viewing backgrounds: the horizon sky and a dark terrain object. The first criterion is a delta E value of 2.0; the second is a green contrast value of 0.05. Results are provided for two assumed worst-case sun angles (to simulate forward and backward scattering of light), with the sun in front and behind the observer, respectively. If either of two screening criteria is exceeded, more comprehensive and realistic analyses should be carried out. Regional haze, which is caused by multiple sources throughout a region, is not calculated or estimated with the VISCREEN model.

The EPA recommends default values for various model parameters. In this analysis, default values were used for all parameters with the exception of background ozone concentration. A value of 0.051 parts per million was assigned as a representative regional value for ozone (DOI 1994; Notar 1998a). DOE used a site-specific annual average background visual range, estimated to be 144 miles based on monitoring programs conducted by the National Park Service at Craters of the Moon Wilderness Area (Notar 1998b).

**Methodology for Mobile Source Impacts**

The SNF & INEL EIS contained an extensive analysis of the ambient air quality impacts at offsite receptor locations due to mobile sources associated with INEEL operations. Sources included the INEEL bus fleet operations, INEEL fleet light- and heavy-duty vehicles, privately-owned vehicles, and heavy-duty commercial vehicles servicing the INEEL facilities. These impacts were quantitatively assessed in the SNF & INEL EIS using emission factors and the computerized CALINE-3 methodology (Benson 1979). The model, which implements the recommended EPA methodology, is considered a screening-level model designed to simulate traffic flow conditions and pollutant dispersion from traffic. The model was used to predict maximum 1-hour ambient air concentrations of carbon monoxide and respirable particulate matter. Regulatory-approved averaging time adjustment factors were used to scale results for other applicable averaging times. All receptor locations were selected within 3 meters from the edge of the roadway, in accordance with EPA guidance. Modeling was conducted for 1993 to quantify the impact due to INEEL buses and traffic serving projects and activities on the INEEL at that time, the projected impact of projects planned for construction before 1995, and the projected impacts of environmental restoration and waste management alternatives given in the SNF & INEL EIS.

The impacts of mobile sources operating at INTEC in support of waste processing operations are qualitatively assessed in Section 5.2.6.7. These impacts are assumed to be bounded by the mobile source impacts assessed in the SNF & INEL EIS.

## C.2.4 RADIOLOGICAL CONSEQUENCES OF WASTE PROCESSING ALTERNATIVES

This section provides detail which supplements the assessment results for airborne radionuclide emissions associated with waste processing alternatives presented in Section 5.2.6.3.

### C.2.4.1 Radionuclide Emission Rates

Radionuclide emission rates for specific projects associated with proposed waste processing alternatives, estimated as described in Section C.2.3.1, are presented in Table C.2-9.

### C.2.4.2 Radiation Doses

DOE has estimated radiation doses that would result from specific projects associated with waste processing alternatives. Table C.2-10 presents estimated radiation dose from airborne radionuclide emissions, averaged over an operational year, for (a) the offsite maximally-exposed individual; (b) the collective offsite population within 80 kilometers of INTEC; and (c) the maximally-exposed non-involved INEEL worker. The organ receiving the highest weighted dose, the most important exposure pathway, and the radionuclide which is the highest contributor to the effective dose are also identified. In each case, the highest predicted non-involved worker location is the Central Facilities Area.

## C.2.5 NONRADIOLOGICAL CONSEQUENCES OF WASTE PROCESSING ALTERNATIVES

This section provides detail which supplements the assessment results for nonradiological air consequences of waste processing alternatives presented in Sections 5.2.6.4 through 5.2.6.6.

### C.2.5.1 Air Pollutant Emission Rates

This section presents nonradiological air pollutant emission rates for specific projects associated with proposed waste processing alternatives, estimated as described in Section C.2.3.1. The following tabulations are presented:

- Table C.2-11 presents a listing of estimated emissions of total and individual criteria pollutants, total toxic air pollutants, and carbon dioxide from fossil fuel combustion. Emissions are listed for individual projects and are summed for each waste processing alternative. The primary source of these emissions is fuel combustion to generate steam. Burning fuel to operate diesel equipment also contributes to these emissions.

- Table C.2-12 presents a listing of emissions estimates for individual toxic air pollutants produced by fossil fuel combustion.

- Table C.2-13 presents estimates of toxic air pollutant, criteria pollutant, and carbon dioxide emissions resulting from chemical processes (other than fossil fuel combustion) that would be used to treat waste under the proposed alternatives.

### C.2.5.2 Concentrations of Nonradiological Air Pollutants at Ambient Air Locations

The following tabulations present the results of assessments for criteria and toxic air pollutant concentrations in ambient air (general public access) locations:

- Table C.2-14 presents the maximum predicted impacts of criteria pollutant emissions at ambient air locations, including at or slightly beyond the INEEL boundary, along public roads traversing the INEEL, and at Craters of the Moon Wilderness Area. The table shows the incremental impacts of each alternative, along with the cumulative impacts when baseline levels are added.

- Table C.2-15 shows the baseline conditions used in cumulative effect determinations. These are the maximum impacts predicted for the indicated locations based on actual 1997 INEEL emissions plus other reasonably foreseeable increases. These increases include projects associated with the SNF & INEL EIS Preferred Alternative, modified to reflect current project plans.

- Table C.2-16 presents a summary of the highest predicted impacts of any single carcinogenic (and noncarcinogenic) toxic air pollutant at offsite and onsite locations. In each case, the maximum impact (in terms of percent of applicable standard) among carcinogens is for nickel, while vanadium is the highest noncarcinogen. As previously noted, toxic air pollutant increments promulgated by the State apply only to new or modified sources that become operational after May 1, 1994. Thus, the contribution from baseline sources is not included when comparing toxic air pollutant impacts to these increments. For each alternative, maximum incremental impacts of carcinogenic air pollutants are projected to occur at or just beyond the southern INEEL boundary, while maximum noncarcinogenic air pollutant levels would occur along U.S. 20.

- Table C.2-17 shows the maximum predicted impacts for each carcinogenic and noncarcinogenic toxic air pollutant at ambient air locations.

### C.2.5.3 Concentrations of Toxic Air Pollutants at Onsite Locations

DOE estimated maximum onsite concentrations of toxic air pollutants for which occupational exposure limits have been established. These levels are presented by waste processing alternative/option in Table C.2-18, and represent the maximum predicted levels at any point within a major INEEL facility area, averaged over an 8-hour period, to which workers might be incidentally exposed. These results are compared to occupational standards recommended by either the American Conference of Governmental

**Table C.2-15.** Criteria pollutant ambient air quality standards and baseline used to assess cumulative impacts at public access locations.

| Pollutant | Applicable standard[a] (micrograms per cubic meter) | Averaging time | Contribution of baseline and reasonable foreseeable increases[b] (micrograms per cubic meter) | | |
|---|---|---|---|---|---|
| | | | Site boundary | Public roads | Craters of the Moon |
| Carbon monoxide | 40,000 | 1-hour | 206 | 420 | 12 |
| | 10,000 | 8-hour | 78 | 66 | 4.2 |
| Nitrogen dioxide | 100 | Annual | 0.46 | 1.2 | 0.06 |
| Sulfur dioxide | 1,300 | 3-hour | 24 | 38 | 3.8 |
| | 365 | 24-hour | 5.3 | 9.9 | 1.2 |
| | 80 | Annual | 0.14 | 0.45 | 0.02 |
| Respirable particulates | 150 | 24-hour | 12 | 24 | 1.0 |
| | 50 | Annual | 0.49 | 1.8 | 0.04 |
| Lead | 1.5 | Quarterly | $2.3 \times 10^{-4}$ | $5.0 \times 10^{-4}$ | $5.5 \times 10^{-5}$ |

a. Cumulative impacts are compared to the applicable standards provided, above. Primary standards are designed to protect public health. Secondary standards are designed to protect public welfare. The more stringent secondary standard was used where applicable for comparison.
b. The baseline represents the modeled pollutant concentrations based on an actual operating emissions scenario. It includes actual 1997 INEEL emissions plus the contribution of reasonably foreseeable increases.

Industrial Hygienists or the Occupational Safety and Health Administration, whichever standard is more restrictive. Unlike radiological impacts (for which the maximum dose to a non-involved worker occurs at Central Facilities Area), the maximally-impacted area for toxic air pollutants is within INTEC. This is due to differences in dispersion models, averaging time (annual average for radionuclides versus 8 hours for toxics) and height of release (elevated releases for radionuclides versus both ground-level and elevated for toxics).

### C.2.5.4 Visibility Impairment Modeling Results

DOE assessed cumulative emissions of proposed waste processing sources at the INTEC for potential impacts on the visual resource at Craters of the Moon Wilderness Area and the Fort Hall Indian Reservation, in recognition of the importance of scenic views in and around each of these areas. For this assessment, the potential impact of incremental emissions was evaluated using maximum hourly emission rates of particulates and nitrogen oxides and minimum and maximum distances from the source to the Class I area and Reservation. The analysis conservatively assumes that future fossil fuel-burning equipment will not have emission controls that reduce nitrogen dioxide and particulate matter emissions. The results (Table C.2-19) show that none of the alternatives would exceed the maximum screening values of 2.0 for color shift or 0.05 for contrast; that is, none would be expected to result in perceptible changes to visual resources around Craters of the Moon or Fort Hall.

## C.2.6 RADIOLOGICAL CONSEQUENCES OF FACILITIES DISPOSITION

This section provides detail which supplements the radiological assessment results for facility disposition alternatives presented in Section 5.3.4. These results are presented separately for three categories of facilities: (a) facilities associated with waste processing alternatives; (b) the Tank Farm, calcine bin sets, and related facilities; and (c) other existing INTEC facilities.

### C.2.6.1 Facilities Associated with Waste Processing Alternatives

Radionuclide emissions would result from the dispositioning of facilities associated with waste processing alternatives. These emissions are temporary in nature and would persist for a few (1 to 4) years following the operating lifetime of individual facilities. Table C.2-20 presents the radionuclide release estimates for the dispositioning of these facilities, while the calculated radiation doses that would result from these emissions are presented in Table C.2-21.

### C.2.6.2 Tank Farm and Bin Sets

DOE estimated emissions and doses that would result from dispositioning the Tank Farm and calcine storage bin sets under different closure scenarios. These emissions could persist for over 20 years, reflecting the lengthy process of decontaminating and closing the waste storage tanks and calcine storage bins. Table C.2-22 presents the radionuclide release estimates for these closure scenarios, while the associated radiation doses are presented in Table C.2-23.

### C.2.6.3 Other Existing INTEC Facilities

DOE estimated emissions and doses that would result from dispositioning various other facilities that either currently operate or have operated in the past in support of HLW management at INTEC. These estimates are presented in Tables C.2-24 and C.2-25.

## C.2.7 NONRADIOLOGICAL CONSEQUENCES OF FACILITIES DISPOSITION

This section provides detail which supplements the emissions estimates and assessment results for nonradiological air pollutants from the facilities disposition alternatives presented in Section 5.3.4. These emissions arise primarily through the operation of diesel-powered equipment (cranes, loaders, haulers, etc.). The emissions tabulations list the maximum annual and cumulative emissions for each pollutant category (criteria, toxic, and carbon dioxide). Criteria pollutant impacts are presented as

**Table C.2-23**. Summary of radiation dose impacts associated with airborne radionuclide emissions from dispositioning the Tank Farm and bin sets under alternative closure scenarios.

| Case | Applicable Standard | Maximum annual radiation dose[a] Clean closure | Performance-based closure | Closure to landfill standards | Performance-based closure with Class A or C grout disposal |
|---|---|---|---|---|---|
| **Tank Farm** | | | | | |
| Dose to maximally-exposed offsite individual (millirem per year) | 10[b] | $1.2\times10^{-9}$ | $1.5\times10^{-10}$ | $1.1\times10^{-9}$ | $1.5\times10^{-10}$ |
| Dose to maximally-exposed onsite noninvolved worker (millirem per year)[c] | 5,000[d] | $1.2\times10^{-9}$ | $1.5\times10^{-10}$ | $1.1\times10^{-9}$ | $1.5\times10^{-10}$ |
| Collective dose to population within 80 kilometers of INTEC (person-rem per year)[e] | NA | $3.1\times10^{-8}$ | $3.8\times10^{-9}$ | $2.8\times10^{-8}$ | $3.9\times10^{-9}$ |
| **Bin Sets** | | | | | |
| Dose to maximally-exposed offsite individual (millirem per year) | 10[b] | $1.0\times10^{-10}$ | $1.3\times10^{-10}$ | $9.2\times10^{-10}$ | $1.3\times10^{-10}$ |
| Dose to maximally-exposed onsite noninvolved worker (millirem per year)[c] | 5,000[d] | $2.3\times10^{-11}$ | $3.0\times10^{-11}$ | $2.2\times10^{-10}$ | $3.0\times10^{-11}$ |
| Collective dose to population within 80 km of INTEC (person-rem per year)[e] | NA | $5.5\times10^{-9}$ | $7.2\times10^{-9}$ | $5.1\times10^{-8}$ | $7.2\times10^{-9}$ |

a. Doses are maximum effective dose equivalents over any single year during which dispositioning occurs. Annual totals include only those projects which are projected to occur over a similar time frame.
b. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.
c. Location of highest onsite dose is Central Facilities Area.
d. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.
e. A reference population of 200,000 people is used for future population dose estimates. At currently projected growth rates, this is the approximate population level that would exist around the year 2030. During 1990, this population was 118,644.

concentrations in micrograms per cubic meter at the maximally-impacted location at or beyond the INEEL boundary, along public roads, and at Craters of the Moon Wilderness Area. These are specified both for the alternative or option alone and for the cumulative effect of the alternative added to the baseline conditions. The cumulative impact is also specified as a percent of the applicable standard. Toxic impacts are presented as maximum percent of the applicable standard (for ambient air locations) or occupational exposure limit (for INEEL areas). In all cases, the INEEL area of highest predicted concentration is INTEC.

### C.2.7.1 Facilities Associated with Waste Processing Alternatives

The following tables of emissions and impacts are presented for dispositioning of facilities associated with waste processing alternatives. Table C.2-26 lists the annual and cumulative emissions estimates for individual projects associated with each alternative. Table C.2-27 presents the maximum predicted impacts of criteria pollutant emissions at ambient air locations. Results include both the incremental impacts of each alternative and the cumulative impacts when baseline levels are added. Table C.2-28 presents a summary of maximum predicted toxic air pollutant impacts at ambient air and INEEL (INTEC) locations.

### C.2.7.2 Tank Farm and Bin Sets

The following tables of emissions and impacts are presented for dispositioning of the Tank Farm and bin sets according to alternative closure scenarios. Table C.2-29 lists the annual and cumulative emissions estimates for each facility group by closure scenario. Table C.2-30 presents the maximum predicted impacts of criteria pollutant emissions at ambient air locations, including both the incremental impacts of each alternative and the cumulative impacts when baseline levels are added. Table C.2-31 presents a summary of maximum predicted toxic air pollutant impacts at ambient air and INEEL (INTEC) locations.

### C.2.7.3 Other Existing INTEC Facilities

DOE has also assessed emissions and impacts for dispositioning other existing INTEC facilities involved in HLW management. These facilities, which have been arranged in functional groups for purposes of analysis, are listed in Table 3-2. The following tables are presented for these facilities. Table C.2-32 lists the annual and cumulative emissions estimates. Table C.2-33 presents the maximum predicted incremental and cumulative impacts of criteria pollutant emissions at ambient air locations. Table C.2-34 presents a summary of maximum predicted toxic air pollutant impacts at ambient air and INEEL (INTEC) locations.

**Table C.2-33.** Maximum criteria pollutant impacts from dispositioning of other existing INTEC facilities associated with HLW management

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